of chemists such as Van't Hoff, Victor Meyer, Wislicenus, and others, who have recently contributed to our knowledge of isomeric bodies.

For the rest, which indeed forms the bulk of the volume, I must content myself with saying that the numerous articles descriptive of organic compounds, ranging from indin on p. 1 to phenyl-tetrazole carboxylic acid on p. 858 (not to mention the inorganic compounds) are mainly contributed by Dr. H. Forster Morley, one of the editors. How far these hundreds of compounds are adequately described, or what mistakes of omission or commission the descriptions may contain, or how many printers' errors exist, must be left to be determined, if determined at all, by someone with more leisure, and, may I add, with more taste for that sort of work than I possess. But I may conclude by saying that, knowing the accuracy and care which uniformly characterize Dr. Morley's work, I do not think that any adverse critic, if such there should be, of this great addition to our chemical literature, will find it a very happy hunting-ground, for, as far as I am able to judge, the work has been carefully and accurately done. H. E. ROSCOE.

THE ENGLISH SLÖJD.

Manual Instruction; Wood-work; the English Sloyd. By S. Barter. With 302 Illustrations. Preface by George Ricks, B.Sc.Lond. (London: Whittaker and Co., 1892.)

IT is to be regretted that the author of this very excellent and practical work should not have stated on the title-page what it really is, *i.e.* a book simply teaching carpentry, including directions for a limited amount of technical or mechanical drawing, and not have termed it "Wood-work," since by this term much is understood which is not given in his pages. Neither is there any occasion for the word which he gives in one place as *Sloyd* and in others as *Slöjd*, it being sufficiently misused already in Swedish by being confined to common incised carving and small carpenter's work, when it is properly applicable to all kinds of technical art. Since Mr. Barter has had the intelligence and boldness to declare that whatever can be done with the barbarous "*Slöjd*" knife can be better done with the chisel, it is to be regretted that, as he is with his English common-sense altogether out of and beyond *Slöjd*, he did not let the Swedish system alone altogether. There was no occasion for him to mention it or its palpable defects, to which he might have added the preposterous arrogance of its claims to be the incarnation of all that is needed to train the hand and eye to industrial art. However, since he who is fitter to be the leader humbly assumes the name, and follows the lead as an English *Slöjder*, we, of course, cannot complain, since it is to his own disadvantage that he assumes a title which detracts seriously from the merits of the treatise. He gives a very good introduction on drawing, which has, however, the serious defect of being beyond the capacity of mere boys, who, while at carpenters' work, certainly cannot be expected to devote hours to learning the meaning and application of "orthographic projection," "the assumption of the existence of parallel horizontal rays of light which project the elevation on a vertical surface," "isometric axes," and "therefore as AC is to CH $: : \sqrt{3} : \sqrt{2}$; but CH = A'K, which is," *et cetera*—all of which, with the diagrams, contrasts strangely with the pictures of the ten-year-old chubby youngsters who are represented as merrily sawing and planing in the frontispiece. It is true that there are little boys who can master Euclid, or its equivalents; but an experience of years in teaching qualifies us to state that a much more simply written chapter than this, or one within the ready comprehension of "boys," would have been better adapted to the book. The forty-two pages devoted to timber are thoroughly scientific, practical, and admirable. Yet as boys seldom have any great choice of wood, and have little to do with teak, ebony, and lignum vitæ, much of the space might have been better devoted to some kind of wood-work not touched on in this book. Materials and tools are well described. We observe that in his illustrations of nails Mr. Barter makes no mention of the very best of all—the triangular, which goes home as straight as a screw, and holds like one.

"Bench-work" is the best portion of the book, being thorough, comprehensive, and manifestly written by a master of the subject. It is not beyond the comprehension of an intelligent boy who will devote to it serious attention; therefore, for such as are somewhat advanced, it may be warmly commended, for the simple reason that intelligent minds pay most serious attention to, and remember best, what costs them some trouble. The author is evidently a very practical, serious, and earnest mechanic, who, understanding his business perfectly, describes everything as he would teach it to a class of young men who had been a while in workshops. But with his "orthographic projections" as with his whole style, he is—not invariably, nor even generally, but very often—too hard for urchins; and, in fact, the juvenile who is depicted on p. 175 as boring a hole has appropriately the pensive air of one who is very much bored himself—probably by some difficulty in the text. Yet all of this does not detract from the fact that the work is an admirable one, that it is the best of its kind, and perfectly adapted to the use of teachers establishing classes, who are, after all, the only persons who really need or read such works, as pupils seldom look at anything of the kind unless required to. But though it is very seldom done, it would have good results if pupils in technical schools should be made to read more, and secondly, if the teacher should carefully explain to them the text.

An excellent feature in the bench work is that the author, giving the names of a majority of such objects as an amateur may expect to make, describes in detail, with excellent and abundant illustrations, how to make them. He might in some cases have gone a little further in his work. Thus it never appears to have occurred to him that parquetry, or inlaid work, can be made save by sawing out pieces of wood in their natural colours. But a large portion of French and Italian work is made by using wood which is artificially coloured, and we should not have expected this to be passed over by a writer who had the intelligence to remark that "Colour, which plays so prominent a part in design, is entirely overlooked in he Slöjd system," which it certainly is, and with it much

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more that is indispensable to teaching the minor arts as a system even to the youngest children. Nor does Mr. Barter mention the so-called Venetian *intarsiatura*, in which the pattern, drawn on one piece of wood, is cut half through the panel, the line being then filled with coloured mastic, and the pattern dyed. But such sins of omission are trifling, though in a book which proclaims on its title that it is devoted to wood-work we should have expected something more than carpentry, and at least a full description of Slöjd carving. And having pointed out, as in conscience bound, every defect, we feel it to be a duty to congratulate the publishers of this remarkably handsome, well-bound, and useful work on having done their best, and on having issued a manual which deserves a place in every industrial school.

But there is a word to be said as regards the preface and a portion of the introduction. It is perfectly true that manual instruction for children develops their intellects, and fits them for life far more than ordinary school studies usually do. But it is not true that this training should consist, as Messrs. Ricks and Barter virtually declare, of nothing but Slöjd, be it Swedish or English, or of carpenters' work. Such training should be for girls as well as boys, and it should be based on design and drawing, taught simultaneously in the simplest and easiest freehand; after which the pupils may take up not merely carpentry, or even Slöjd—which is nothing effectively but a minor branch of wood-carving—but also wood-carving itself, and many other arts, all of which come as one and promptly to the pupil who can design, and, when occasion favours, also can model a little. But to expect that carpentry alone, without a trace of art, is all that is needed to inspire the creative faculty is a great mistake; and what is worse is that, despite thousands of living examples of the superiority of the more artistic method for children, the British—like the American—public persists in believing that all that is needed is to teach "our boys" how to make benches and boxes.

OUR BOOK SHELF.

Thermodynamische Studien. Von J. Willard Gibbs, übersetzt von W. Ostwald. (Leipzig: Engelmann, 1892.)

THIS is a German translation of three of Prof. Gibbs's Thermodynamic Papers. These were published during the years 1873-8, in the Transactions of the Connecticut Academy (vols. ii. and iii.); and one reason which prompted Prof. Ostwald to undertake the translation of them was their inaccessibility to the general scientific public. Their importance is sufficiently attested by the fact that part of the ground covered by Prof. Gibbs has been gone over again by later writers who deemed they were themselves pioneers.

"Graphical Methods in the Thermodynamics of Fluids" is the title of the first paper. It gives for the first time a general account of the comparative advantages of using various pairs of the five fundamental thermodynamic quantities for graphical representation. The entropy-temperature and entropy-volume diagrams are discussed in considerable detail. The second paper contains the description of the volume-energy-entropy surface, which generally goes by the name of Gibbs's thermodynamic surface. Its contents are familiar to all who have studied Maxwell's "Theory of Heat."

The third paper, "On the Equilibrium of Heterogeneous Substances," fills five-sixths (344 pages) of the whole book, and is, out of question, by far the weightiest contribution which Prof. Gibbs has made to the development of thermodynamic methods. To him must be given the credit of first formulating the energy-entropy criterion of equilibrium and stability, and developing it in a form applicable to the complicated problems of dissociation. To give anything like a complete idea of the contents of this paper, with its discussion of critical points, capillarity, growth of crystals, electromotive force, &c., would mean the reproduction of Prof. Gibbs's own very full synopsis, which in the German translation forms the greater part of the table of contents of the book. It will suffice to notice the general theory of the voltaic cell, with which the paper ends. Here distinctly for the first time is it pointed out that the electromotive force of the cell depends on other factors than the variations of its energy. Von Helmholtz's theory, which differs from that given by Prof. Gibbs only in the greater fulness of detail, was not published till 1882.

Prof. Ostwald tells us that he had the benefit of the author's revision. With the exception of a few obvious corrections the original papers are most faithfully reproduced, even to certain footnotes which in these days have no particular value. In the circumstances a little license might well have been taken, and a slavish adherence to the original text departed from. For example, it is surely most desirable to use the word *isenergic* for lines of equal energy, and not the inappropriate term *isodynamic* which Prof. Gibbs made use of in his paper of 1873. Again, we question the right of any writer on thermodynamics to use the word *reversible* in other than Carnot's sense. Such double meanings tend to produce confusion, in spite of elaborate footnotes.

These blemishes apart, however, there is no doubt that Prof. Ostwald deserves great credit for his labour of love in preparing this translation. He has made it possible for the many, who know of Prof. Gibbs's work only at second hand, to acquaint themselves with the original papers, and we feel confident that the book will find its place on the shelves of all who desire a really complete library of thermodynamic literature.

Elements of Physic. By C. E. Fessenden. (London: Macmillan and Co., 1892.)

THE subject matter of this book is arranged in four chapters—Matter and its Properties, Kinematics, Dynamics (including statics, hydrostatics, and pneumatics), and Heat. It thus forms an excellent introduction to a more extended study of physical science. The treatment of the subject is based largely on simple experiments to be performed by the student himself, whose reasoning powers the author seeks to draw out as far as possible by suggestive questions interspersed through the text. The following example will give a good idea of the style of treatment:—

". . . All experience teaches that *no two portions of matter can occupy the same space at the same time.* This property which matter possesses of excluding other matter from its own space, is called *impenetrability*. It is peculiar to matter, nothing else possesses it. These facts being known, let us proceed to put certain interrogations to nature. Is air matter? Is a vessel full of air a vessel full of nothing? Is it 'empty'? *Can matter exist in an invisible state?*

"*Experiment* 1.—Float a cork on a surface of water, cover it with a tumbler, or tall glass jar, and thrust the glass vessel, mouth downward, into the water. . . . State *how* the experiment answers each of the above questions and what evidence it furnishes that air is matter, or, at least, that air is like matter.

"*Experiment* 2.—Hold a test tube for a minute over the

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